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Teachers' Experience and Students' Numerical Proficiency in Solving Physics Problems in Secondary Schools

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Abstract

This paper examined the influence of teachers 'experience on students' numerical proficiency in solving physics problems in secondary school in north central zone of Nigeria. SS 111 physics teachers from sixty co-educational secondary schools were selected using purposive sampling technique. (Sixty co-educational secondary schools and their SSS111 physics teachers were selected using purposeful sampling technique). The population of teachers that participated in the study was sixty (60). Thirty nine of the schools were taught by experienced physics teachers and twenty one schools by less experienced physics teachers. The Sampled students were made up of 300 males and 300 females. Data collected through Numerical Proficiency Test and Physics Teachers Problem Solving questionnaire were subjected to t-test. Five null hypotheses were formed and tested at 5% level of significance. Results show that numerical proficiency of students taught by experienced teachers were better than those taught by less experienced teachers. There was no significant difference in the numerical proficiency of male and female students taught by less-experienced physics teachers.

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However, there was significant gender difference in numerical proficiency of those students taught by experienced teachers. It was concluded that students taught by experienced teachers were numerically more proficient than their counterparts taught by les experienced physics teachers.

Key words: Teacher's experience, numerical proficiency, problem solving, secondary school physics, students

Introduction

The role of science in technological development has long been realized in many developing countries. In Nigeria, this has necessitated the government policy of not less than 60% of places allocated to science and science oriented courses in higher institutions (FRN, 2004). The study of the sciences especially physics and capacity building for technological development is predicated on teacher's quality, because no education can rise above teachers' quality.

According to Ijaya (2000), teachers' experience improves teaching skills and makes students learn better in the hand of a teacher. It is a known fact that a professional teacher becomes more efficient and more effective as he stays longer on the profession by learning more on the job and learns more about the difficulties students encounter while learning (Abiri,1988; Ogunkunle, 2007). In the same vein, Apata (2007) remarked that experience serves to nourish teachers through exposure to training, rearing and upbringing, and socialized them into teaching culture that translates into good pedagogic technique and problem solving strategies required of physics students.

Students need to be mathematically inclined to have good learning in physics and be proficient in the problem solving skills needed for guided discovery method adopted in physics learning (CESAC, 1970; Meyer 2001). Mathematics provides the basis for stimulating learning in physics through;

1. Provision of concise statement that is devoid of English words.
2. Expression of relation that exists in most concepts by mathematical structure.
3. Mathematical rules that aid students' understanding in how concepts are related and simplify problem solving strategy.

A physicist must have a good understanding of basic physical laws using calculative skills to solve problems (Wilkins, 1999). Mathematics is used to clarify the concepts and principle of physics and serves as basis for numerical proficiency that is needed to solve problems in physics (Apata, 2011).

In spite of the universal recognition of the importance of physics to technological development and a number of studies been conducted on experience and students' learning outcomes in various subjects (Richard and Barbara, 2002; Rice, 2003; and Adeyemi, 2008), evidence abound that students were not numerically proficient in solving problems in physics (WASSCE, 2004; Apata, 2011). Hence, a perennially low achievement in physics in senior school certificate examinations.

However, many studies have been conducted to address the issue of the failure rates of students in physics. Adenugba (2000) reported the usefulness and pitfall of microcomputers to physics education and advocated the use of computers to enhance students' performance in physics through practical design of multi-stage opera amplifier. Owolabi (2006) demonstrated how physics can be taught by using out-of-class learning experiences within the immediate environment of the learners. The underlying emphasis is to teach physics so as to provide understanding base learning experiences. Therefore, this study deals with the strength of students to perform numerical processes with the aim of proffering solution to mathematical problems in physics in the atmosphere of teachers' experience. However, scanty studies have been carried out on teachers' experience and numerical proficiency. Thus, information on the influence of teachers' experience on numerical proficiency of students in solving problems in senior secondary school physics is limited. For this reason, there is need to provide information on numerical proficiency in senior secondary school physics.

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

H_{01} There is no significant difference in the numerical proficiency of students taught by experienced physics teachers and those taught by less-experienced physics teachers.

H_{02} There is no significant difference in the numerical proficiency of male and female students taught by experienced physics teachers.

H_{03} There is no significant difference in the numerical proficiency of male and female students taught by less-experienced physics teachers.

H_{04} There is no significant difference in the numerical proficiency of males taught by experienced physics teachers and males taught by less-experienced physics teachers.

H_{05} There is no significant difference in the numerical proficiency of females taught by experienced physics teachers and females taught by less experienced physics teachers.

Methodology

Population for the study was made up of SSS111 physics students in north central zone, Nigeria. Sixty co-educational schools that satisfied the criteria relevant to the study were selected from Kogi, Kwara and Niger states of the zone. SSS III physics teachers of the selected schools participated in the study. The population of teachers that participated in the study was sixty (60). Thirty nine of these schools were taught by experienced teachers and Twenty one schools by less-experienced physics teachers. Intact classes of physics students participated at the SS III level. Through random and stratified sampling technique, five male and five female students were selected from each of the participating schools. The sample size was six hundred students (300 males and 300 females).

Two relevant instruments were employed for the study. The Physics Teachers' Problem Solving Questionnaire (PTPSQ), used for personal data on teachers' information and Numerical Proficiency Test (NPT), instrument adopted from WAEC past questions which comprised of alternative to physics practical questions and physics theory questions. The instrument which had undergone reliability and validity test was used to assess the numerical proficiency of students. The face and content validity of PTPSQ instrument were carried out by three physics educators .The researcher went through the scheme of work of all the participating schools two weeks before the test to ensure syllabus coverage. The test was administered and lasted for 2hours: 40minutes. Students' scripts were collected immediately after the test for grading. The WAEC marking scheme was used to provide solutions to questions in the NPT. Data collected were analyzed using t-test for hypotheses one through five.

In this study, experienced teachers are teachers that have taught for five years and above, while the less experienced teachers are those within zero and four years of teaching experience only.

Results

The results obtained are presented and discussed on the bases of the hypotheses tested.

Hypothesis 1:

H_{01} There is no significant difference in the numerical proficiency of students taught by experienced physics teachers and those taught by less-experienced physics teachers.

From the data in table 1, the P value is .000, which is less than the alpha level of 0.05. This implies that the tested hypothesis is significant, since there is a significant difference between the students taught by experienced physics teachers and those taught by less experienced physics teachers. Therefore, the null hypothesis is rejected.

Hypothesis 2:

H_{02} There is no significant difference in the numerical proficiency of male and female students taught by experienced physics teachers.

The data for testing this hypothesis is presented in table 2.

From the data shown in table 2, the P value is 0.001 which is less than alpha level of 0.05. This implies that the tested hypothesis is significant since there is a significant difference between male and female students taught by experienced physics teachers. Therefore, the null hypothesis, which states that there is no significant difference in the numerical proficiency of male and female students taught by experienced physics teacher is hereby rejected.

Hypothesis 3:

H_{03} There is no significant difference in the numerical proficiency of male and female students taught by less-experienced physics teachers.

The data for testing this hypothesis is presented in table 3.

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From the data shown in table 3, the P value is 0.177, which is greater than 0.05 alpha level. In view of the above result, the null hypothesis, which states that there is no significant difference in the numerical proficiency of males taught by less-experienced physics teachers and female students taught by less experienced physics teachers, is accepted.

Hypothesis 4:

H_{04} There is no significant difference in the numerical proficiency of males taught by experienced physics teachers and males taught by less-experienced physics teachers.

The data for testing this hypothesis is presented in table 4.

From the data shown in table 4, the P value is .000, which is less than the alpha level of 0.05. This implies that the tested hypothesis is significant, which means that numerical proficiency of males taught by experienced physics teachers is 15.24 and 10.09 for males taught by less-experienced. There is a significant difference between the numerical proficiency of males taught by experienced physics teachers and males taught by less-experienced physics teachers. Therefore the null hypothesis is rejected.

Hypothesis 5:

H_{05} There is no significant difference in the numerical proficiency of females taught by experienced physics teachers and females taught by less experienced physics teachers.

The data for testing this hypothesis is presented in table 5.

From the data shown in table 5, the P value is 0.020, which is less than alpha level of 0.05. Hence, there is a significant difference between the numerical proficiency of females taught by experienced physics teachers and females taught by less-experienced physics teachers. The null hypothesis, which postulates that there is no significant difference between the numerical proficiency of females taught by experienced physics teachers and females taught by less-experienced physics teachers, is therefore rejected.

Discussion of findings

This study investigated the influence of physics teachers' experience on students' numerical proficiency in solving physics problems. The study revealed that the numerical proficiency of students taught by experienced

physics teachers was better than those taught by less-experienced physics teachers. This is in agreement with the findings of Olokoba (2000); Ijaiya (2000); Richard and Barbara (2002) who found that experienced teachers were more productive than their inexperienced counterparts. Adeyemi (2008) explained that schools having more teachers with five years' and above teaching experience achieve better results than schools having more teachers with less than five years' teaching experience. Also, Razouki (1987) found that experience improves teaching skills and pupils learn better in the hands of teachers who have taught them continuously over a period of years. Similarly, Rice (2003) reported that teachers become more skillful with experience.

Common position of these findings is that experience of a teacher affects the students' performance. However, the significantly better performance of students taught by experienced physics teachers was in contrast to Etuk (1984) and Aaronson, Barrow and Sander (2007), who could not establish any significant difference between the experience of teachers and students' achievement, and found that teachers with low experience surpassed others in their resourcefulness because they are more in touch with the subject matter.

The performance of students taught by experienced physics teachers was better than those taught by less-experienced teachers. This could be due to the fact that the experienced teachers might have been a regular West African Examinations Council (WAEC) and/or National Examinations Council (NECO) examiners as well as participants in workshops and seminars that are knowledge-based and teaching methods-driven, which contributed to the better performance of the students taught. Male students taught by experienced physics teachers had better numerical proficiency than their female counterparts, whereas male and female students taught by less-experienced physics teachers were similar in their proficiency. Comparison of male students taught by experienced physics teachers and those taught by less-experienced physics teachers showed significantly better performance in favour of the experienced teachers. Similar trend was also observed with the female students.

The present study further revealed that for both male and female, the students of experienced teachers outperformed those of the less-experienced teachers. This is in agreement with the findings of Olokoba (2000), Ifamuyiwa (2004) and Ogunkunle (2007). The experienced teachers are already socialized into teaching culture, usually more matured, and gender friendly hence can

mobilise the experience and exposure they have acquired to promote effective teaching and learning in schools, especially in numerical proficiency of their students as evidenced in the study.

Implications of the findings

It helps the principals to know the productivity of experienced and less experienced teachers and think of strategy of how to bridge the gap. Teachers are aware of the appropriate methodology and class room management to be adopted to have successful practice in the job. It assists the policy maker to find a strategy of how they can train teachers through workshops and seminars that are of high academic standard and teachers pedagogic driven which produce highly skilled and creative teachers that bring optimum numerical proficiency in physics students.

Conclusion

Students taught by experienced teachers outperformed those students taught by less-experienced teachers. The number of experienced teachers was twice the number of less-experienced teachers. Teachers' experience was found to have positive impact on numerical proficiency. However, male and female students taught by less-experienced teachers did not differ in their proficiency.

Recommendation

It is recommended that physics teachers should be well motivated to minimize the exodus of experienced physics teachers and the less experienced teachers should be helped through mentoring in the job.

Experienced physics teachers should be engaged and distributed evenly to schools to enhance students' performance across board.

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Table 1: T-test on the Numerical Proficiency of the Students taught by experienced physics teachers and those taught by less-experienced physics teachers

Variables	No. of Cases	Mean score	Standard deviation	T	df	P
Experienced teachers' students	390	13.26	13.9	4.250	598	.000
Less-experienced teachers' students	210	9.25	10.3			

Significant level at 0.05

Table 2: T-test on the Numerical Proficiency of Male and Female Students taught by Experienced Physics Teachers

Variables	No. of Cases	Mean score	Standard deviation	t	df	P
Male students	195	15.24	15.0	3.397	388	.001
Female students	195	11.27	12.3			

Significant level at 0.05

Table 3: T-test to show significant difference between male and female students taught by Less-experienced Physics Teachers

Variables	No. of Cases	Mean score	Standard deviation	t	df	P
Male students	105	10.09	10.3	1.352	**208**	.177
Female students	105	8.43	10.2			

Significant level at 0.05

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Table 4: T-test to show significant difference between the numerical proficiency of males taught by experienced Physics Teachers and males taught by less-experienced Physics Teachers

Variables	No. of Cases	Mean score	Standard deviation	t	df	P
Experienced Teachers	195	15.24	15.0	3.625	298	.000
Less-experienced Teachers	105	10.09	10.3			

Significant level at 0.05

Table 5: T-test to show significant difference between the numerical proficiency of females taught by experienced Physics Teachers and females taught by less-experienced Physics Teachers

Variables	No. of Cases	Mean Score	Standard deviation	t	df	P
Experienced Teachers	195	11.27	12.3	2.342	298	.020
Less-experienced Teachers	105	8.43	10.2			

Significant level at 0.05

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